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Current Opinion in Environmental Sustainability

DOI:
[10.1016/j.cosust.2023.101363](https://doi.org/10.1016/j.cosust.2023.101363)

Published: 01/12/2023

Peer reviewed version

[Cyswllt i'r cyhoeddiad / Link to publication](#)

Dyfyniad o'r fersiwn a gyhoeddwyd / Citation for published version (APA):
Martini, E., Pagella, T., Mollee, E., & van Noordwijk, M. (2023). Relational values in locally adaptive farmer-to-farmer extension: how important? *Current Opinion in Environmental Sustainability*, 65, Article 101363. <https://doi.org/10.1016/j.cosust.2023.101363>

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2 **Relational values in locally adaptive farmer-to-farmer extension:**
3 **how important?**

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9 **Short title: locally adaptive farmer-to-farmer extension**

10 **Highlights**

- 11 • Farmer-to-farmer extension prioritizes rural livelihoods over yield increase.
- 12 • Relevance, trust, and place attachment strengthen farmer-to-farmer extension.
- 13 • Relational values support adaptive capacity of connected farming communities.
- 14 • Strengthened relational values support the use of best-fit agricultural innovations.

15 **Abstract**

16 Values held in agricultural extension systems determine which extension goals can be reached.
17 Globally changing socio-ecological contexts require a paradigm shift in agricultural extension systems
18 from a top-down approach dominated by instrumental values to achieve the primary goal of
19 increasing yields, to a more site-specific relational and participatory approach that induces locally
20 adaptive use of sustainable agricultural practices. A literature review was conducted to understand
21 how relational values in farmer-to-farmer extension align with participatory agricultural extension
22 systems. Relevance, trust, and place attachment are the main relational values expressed in farmer-
23 to-farmer extension where participatory processes incorporate farmers' livelihood outcomes in the
24 transformational goals of agricultural extension. Recognizing and strengthening the relational values
25 in farmer-to-farmer extension, based on different contexts, will likely support the development of
26 locally adapted knowledge and innovations, and provides a basic rationale for building communication
27 strategies, co-learning, and supporting behavioural change of all agricultural extension actors.

28 **Keywords:**

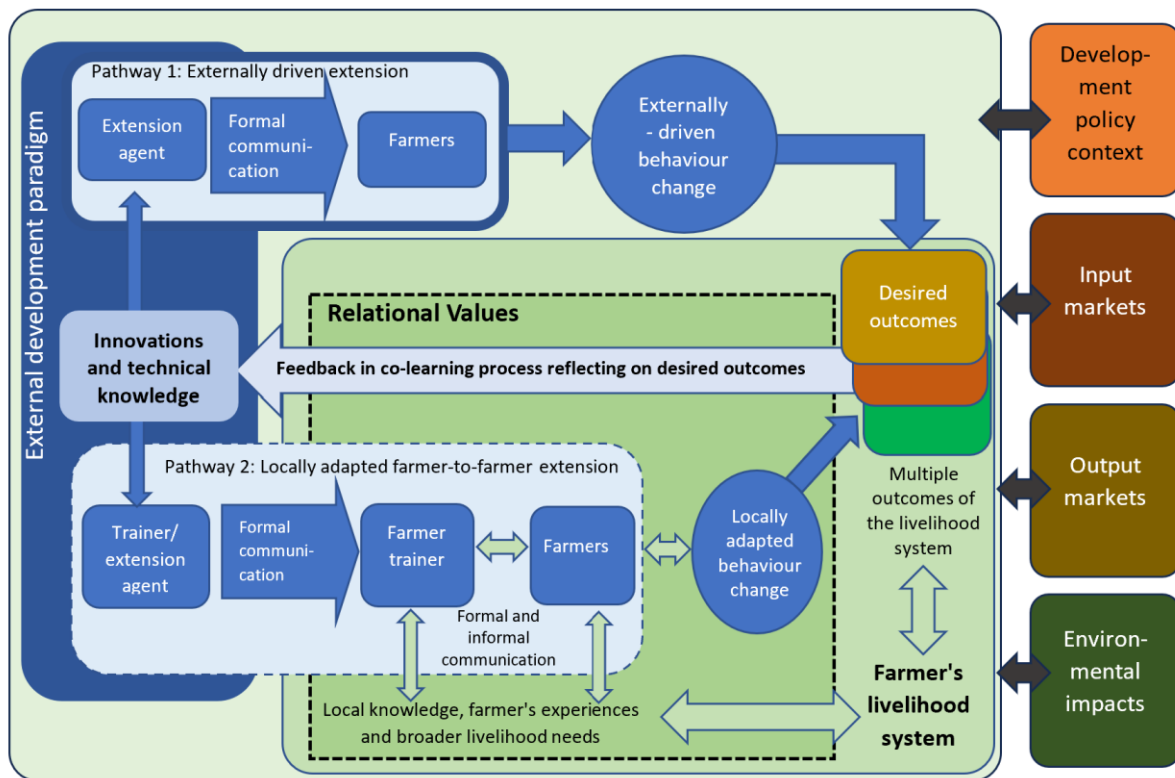
29 Participation, relevance, trust, place attachment, livelihood systems, co-learning

30 **Introduction**

31 Agricultural extension is part of the social sub-system of the rural socio-ecological systems that shape
32 livelihoods and landscapes, deriving agroecosystem products and services [1]. Increasingly, these
33 services are understood to be both 'instrumental', helping people to achieve their goals, and
34 'relational', helping people to maintain harmony among social actors [2] and in the human-nature
35 relationship [3,4]. Agricultural extension is a means to an end; as the goals are in flux or even in a crisis
36 [5], the means require adjustment [6]. Just as it was a few decades ago, successful agricultural
37 extension is still expected to contribute to food security issues at the national level with a high
38 emphasis on maximizing production [7]. Current shifting societal perspectives on what the public

39 sector expects as the direction of change for the agricultural sector and rural land use management
 40 imply changing roles for extension [8, 9] to be aligned with the emergence of a more decentralized,
 41 farmer-led, and market-driven extension system [10]. Moreover, there are many current opinions on
 42 desirable directions of change for farming and farmers in countries in all stages of economic
 43 development [11]. Priorities include closing yield gaps by increasing input use through improving soil
 44 health [12,13], or achieving principles of agroecology to mitigate climate change [14]. The changes
 45 have been discussed as transforming a subsistence based “Ag1.0” through stronger market
 46 integration, specialization, and homogenization with increased reliance on external inputs, to the
 47 prominence of digital technologies for “precision farming” labelled as “Ag4.0”, part of the supply chain
 48 for a modern “Industry 4.0” [15,16].

49 Farmers have always talked to other farmers. Formalized and externally supported farmer-to-farmer
 50 extension is, however, relatively new. As a farmer-led low-cost participatory approach it is now
 51 commonly applied to achieve agricultural extension goals [17,18]. In this system the primary extension
 52 agent is a trained farmer who lives in the local community and understands its context and
 53 complements an externally driven pathway (Figure 1).



54

55 Figure 1. Relational values in locally adaptive farmer-to-farmer extension pathways

56 Knowledge transfer is most effective if three quality characteristics (credibility, salience, and
 57 legitimacy) are simultaneously present from the potential user perspective [19]. Innovation and
 58 technical knowledge are transferred to farmers through two pathways, (i) Pathway 1 is externally
 59 driven extension based on formal communication, with strong influence from the external
 60 development paradigm and/or input or output market interests; and (ii) Pathway 2 is the locally
 61 adapted farmer-to-farmer extension based on formal and informal communication with the inclusion
 62 of farmer's livelihood systems such as local knowledge, farmer's experiences and broader livelihood
 63 needs. Relational values connect the two pathways through the generation of innovation that
 64 considers farmers' feedback based on their desired outcomes.

65 This paper takes stock of recent studies on how the relational values of nature-people and people-
 66 people interactions can be used in farmer-to-farmer extension to support locally adaptive agricultural
 67 systems. This paper first describes how values held in the extension systems are influenced by the
 68 shift in societal expectations for rural landscapes under various contexts, as represented in
 69 transformational phases of agricultural development. It then explores what values are embedded in a
 70 participatory agricultural extension system and how these influence pathway two.

71 **Values in the transformational phases of agricultural development**

72 The non-linear changes in agricultural development (slowly at first, until positive feedback loops
 73 accelerate change) are characterized by ‘tipping points’ or transformational phases, where change
 74 becomes unstoppable. A recent characterization of four historical phases in the way people relate to
 75 forests [20], can be extended to a history of how the Human-Nature relationship (and the relational
 76 and instrumental values expressed) developed, with three tipping points in the transitions between
 77 the four phases (Table 1). The three tipping points in agricultural change that we focus on in the
 78 context of agricultural extension are: first (‘Green revolution’) a triumph of instrumental, science-
 79 based technical control over constraints posed by the natural context of human livelihoods, followed
 80 by recognition of environmental damage by unconstrained input use that stimulates smarter
 81 technologies as second tipping point (‘Rational intensification’). The third tipping point (‘Regenerative
 82 agriculture’, 21) can lead to a re-emergence of relational values of nature in wider society and change
 83 external expectations on how agriculture should function.

84 Table 1. Birds-eye view on three agricultural transitions (tipping points) between the four phases (I –
 85 IV) of an instrumental/relational value transition in (formerly) forested landscapes [20]

Transition Aspect	I. → II. “Green revolution”	II. → III. “Rational intensification”	III. → IV. “Regenerative agriculture”
Societal goals	Food production (SDG2), Economic growth (SDG1,8)	SDGs 1, 2, 8 + Water (SDG 6), Energy (SDG 7), Climate change (SDG 13), Life in water and on land (SDG14, 15)	SDGs 1,2,6,7,13,14,15 + Health (SDG3), Gender equality (SDG5), Reduced inequalities (SDG 10), Responsible production and consumption (SDG 12)
Eco-technical	Technology to overcome natural constraints: combined use of high-yield germplasm, fertilizer, pesticides; mechanization to reduce labour dependence	Ecological intensification, reducing environmental impacts while increasing land productivity; technical approaches to precision farming can increase efficiency.	(Urban) consumer involvement in opinions about environmental impacts and footprints of the products they use; rise of demand for ecocertification
Economic	Stabilizing fluctuating markets; creating conditions for rural credit and financial investment, through land ownership as collateral; farm specialization; import substitution while securing a positive trade balance by exports	Privatization of agricultural extension increases role of commercial input-providers, focus on ‘winners’; value chains become target of research and public policy interventions	Claims for deforestation-free and carbon-positive value chains bring a new agenda to extension and new types of investment to rural landscapes; in accessible landscapes, local/international ecotourism leads to shifts from goods to services as basis of rural income

Socio-economic	Affordable domestic staple food supply; agrarian transformation, with rural labour shifting to urban/ industrial jobs, land consolidation to 'viable' farm sizes	Green growth and climate-smart agriculture emerge as rallying points for public-private partnership	'Living wage' concerns in tropical tree commodities
Social	Little awareness of, and challenge to, gender bias in distribution of costs and benefits of intensification	NGO-funded extension emerges with social focus at prioritized locations	Specific efforts are needed to achieve gender and create opportunities for smallholders
Extension	Seen as public responsibility in agriculture	Privatized, industry-centred where input-market value chains justify investment; NGO-funded projects also engage	Ecocertification intermediaries provide extension services, emphasizing farmer groups for scale

86

87 Across these three transformational phases, agricultural extension operates at the interface of
88 connecting farmers to external knowledge and market-related networks [22]. Under the best
89 circumstances, extension agents can become trusted sources of understanding, data and advice and
90 assist decision-making [23]. By contrast, they can also be seen as largely irrelevant, representing
91 government or private sector agendas rather than genuine local interests [24].

92 When the target in the green revolution transition was to support 'progressive' farmers, hungry for
93 information on new technologies in agricultural production, the formally educated extension agents
94 were adequately prepared for their job – although physical limitations on who they could reach with
95 existing mobility budgets often restricted access to their services. When the second and third
96 transformation targets shifted to poverty reduction, gender equity and social inclusion, and
97 sustainable land use management, new skills and more efforts were needed to earn the trust of the
98 target audiences and other extension agents [25]. More reliance on extension agents who lived in (or
99 at least originated from) the local community in more locally adaptive extension strategies are
100 expected to fill the gap, such as by connecting with farmers' organizations [26], and explicitly engaging
101 youth [27] and other marginalized social entities in rural livelihoods [28,29]. The way farmer decision-
102 making has been understood has shifted from purely economic (extended cost-benefit analysis) to
103 more socially embedded in relationships, status, and power [30].

104 **What values are embedded in a participatory agricultural extension system?**

105 The term value can indicate high-level, non-tradable principles, exchange rates in negotiated trade-
106 offs or a numerical equivalent on any scale of measurement. Values are critical motivators of
107 behaviour and attitudes, linked to individual affection, social affiliation and expressed goals [31]. In
108 agricultural extension, both instrumental and relational values are needed. Instrumental values are
109 goal-oriented, relational ones are harmony-oriented. Their interaction across a wide range of cultural
110 settings can according to 'Relational models theory' of Fiske [32] be described in terms of just four
111 "relational models": communal sharing (every member of group has equal right to the shared
112 resources), authority ranking (those of higher status or power are entitled to a larger share of the
113 common resources), equality matching (various forms of in-kind reciprocity) and market pricing (one
114 gets a proportion equivalent to what he/she pays). These inter-human relations can also include other-
115 than-human parts of nature, e.g., in ecosystem management [33]. Relational values reflect the

116 qualities of the relationships, such as relevance, trust, care, social bonding, place attachment and
117 spiritual meanings [34]. Relational values support the participating behaviour of people and promote
118 their involvement in a socio-ecological system [35]. In supporting agricultural development,
119 agricultural extension, aiming to be a trusted source of information [36], thus operates on the
120 interface of instrumental and relational values.

121 Agricultural extension used to be (first column in Table 1) a main instrument for governments to
122 'modernize' a 'backward' agricultural sector, pushing intensification of land use based on agricultural
123 inputs, facilitating access to credit, and assisting with the roll-out of government programs [16]. The
124 goals for public agricultural extension systems, such as increasing food production and commodity
125 supply, led to a focus on maximizing production by introducing innovations produced by research
126 agencies which seek general applications, not constrained by the local contexts such as local
127 knowledge, farmer's preferences and needs [18].

128 Not including farmers' perspectives in the development of knowledge and innovation may lead to
129 farmers' low participation in agricultural extension due to irrelevant knowledge that does not match
130 their needs [37]. Farmers' participation in extension services significantly influenced farmer
131 satisfaction [38]. Participation is a process through which stakeholders collaboratively set objectives,
132 create a strategy, and formulate tactics to achieve goals [37]. To get farmers to participate in societal
133 goal achievement, extension agents may first have to participate in local communities. In the
134 participatory approach, power dynamics influence the effectiveness of the engagement, the values of
135 participants and the way knowledge is constructed and considered valid [39]. Understanding the
136 relational values in participation can help develop an extension strategy based on farmers' needs or
137 demand driven. The concept of demand-driven services is expected to develop extension strategies
138 to be more responsive to the needs of all farmers, including women and other marginalized groups
139 [40, 41]. Based on an analysis by the World Bank [30] on the generic issues in agricultural extension,
140 applying a participatory extension approach mitigates most of the issues. Values embedded in the
141 participatory extension are reflected in its principles [42, 43]:

- 142 a) Oriented to farmer's needs, local resources, social systems, culture, and gender differences
143 [*Relevance*];
- 144 b) Two-way interaction of learning and communication between farmers with extension agents
145 [*Trust*]
- 146 c) Primary objective is farmers' welfare, that beyond increased production requires
147 sustainability and competitive agribusiness [*Relevance*];
- 148 d) Farmers become active partners in disseminating information and creating innovation
149 [*Trust*];
- 150 e) The intention is more on farmers' innovation adaptation than farmers' adoption of
151 innovation [*Place attachment*].

152
153 Farmer Field Schools are a popular format for participatory extension. When properly integrated, a
154 Farmer Field School was found to strengthen the climate change adaptation behaviour of agribusiness
155 champions, farmers, and supply chain actors at reduced training costs [44]. Farmer Field Schools
156 remain functional, but the vision of agricultural development they promote can be undermined by
157 simultaneous policies of the relevant ministry to support forms of contract farming where farmers
158 have little freedom to innovate, as a recent study for Indonesia suggested [45]. Currently, Farmer Field
159 Schools have shifted from a focus on technology transfer to consultative or collaborative participation
160 at the farm level, but the evaluation criteria have not shifted along, creating a challenge to the analysis
161 of performance [46]. Thus, another form of participatory extension approach needs further

162 exploration, such as a farmer-to-farmer extension. Participatory extension models, including explicit
163 social capital-building and social learning strategies, enhance the adoption of complex agricultural
164 practices compared with traditional models [47].

165 **Relational values in a locally adaptive farmer-to-farmer extension**

166 A farmer-to-farmer extension system is a participatory approach that holds instrumental and
167 relational values. Despite the high relevance of relational values, the importance of relational values
168 in farmer-to-farmer extension is understudied. No references were found to relational values in the
169 farmer-to-farmer extension in the Web of Science database.

170 Based on the studies, applying farmer-to-farmer extension provide benefits of (1) lower cost for
171 disseminating simple technologies [18]; (2) farmer-to-farmer extension can assist the widespread of
172 technologies [48,49,50]; (3) farmer-to-farmer extension can overcome language barriers that public
173 extension agents often encounter (51, 52); and (4) farmer-to-farmer extension is effective to stimulate
174 adoption of simple technologies such as planting native species [47,53]. In the past years, the farmer-
175 to-farmer extension has been promoted to disseminate information and technologies related to site-
176 specific or locally adaptive interventions, such as to enhance farmers' resilience to climate change
177 [44,54,55], and to support the application of sustainable land management practices specific to
178 agriculture, including crop residue integration, terracing, mulching, manuring, composting, legume
179 intercropping, planting cover crops and agroforestry [13,56].

180 From the existing studies worldwide, factors that affect the effectiveness of farmer-to-farmer are
181 related to the quality of farmer trainers, technological complexity and the communication mode
182 between farmer trainees and farmer trainers and support from other extension services as sources of
183 information [57,58, 59]. Another critical factor is the availability of local knowledge related to the
184 introduced technology[60]. To assist adoption, the farmer-to-farmer extension must complement the
185 other extension systems that link to government support and other non-government initiatives;
186 extension is just one factor influencing farmers' adoption capacity [61].

187 Relational values are embedded in the farmer-to-farmer extension through the agent of change, i.e.,
188 farmer trainer. The farmer trainer, who originated from the same area as the farmers and understood
189 the relevance of the extension goals with the local livelihood systems, received innovation from public
190 extension agents and adjusted the innovation with the local knowledge and farmers' experiences and
191 needs. Adjusting the innovation is important, particularly for implementing innovations such as
192 climate-smart agriculture and sustainable land use management influenced by variations of local
193 contexts; through its *relevance values*, farmer trainers can adjust the innovations to fit the local
194 contexts. *Place attachment* between farmer trainers with their environment will also be able to adjust
195 the innovations to the biophysical requirements when applied to a specific site. Interaction between
196 farmer trainers and farmers is based on formal and informal communication. *Trust* is relatively easier
197 to develop in the farmer-to-farmer extension, as farmer trainers and farmers have similar interests
198 and motivations to improve agricultural practices [62]. On the other hand, farmers will need evidence-
199 based trust when interacting with public extension agents. The extension agent needs to provide
200 evidence that fits well with the expected benefits for the farmers. Trust is a key value that affects the
201 learning process and participation in the farmer-to-farmer extension [63].

202 **Conclusions and ways forward**

203 Farmer-to-farmer extension as approach was developed based on what farmers have traditionally
204 used to disseminate agricultural information and technologies. It is part of an agricultural extension
205 paradigm that highlights site-specific strategies. This means that extension is evaluated not only as

206 instrumental to a change in what farmers do or know but also on how it helps farmers achieve and
207 perceive more relevance to their local contexts (nature, community, markets, government) and
208 challenges (blending tradition and innovation). Site-specific extension strategies demand inclusivity of
209 local perspectives and engagement of the local actors, both the farmers and the extension agents, in
210 shaping a participatory approach. The farmer-to-farmer extension can implicitly facilitate the
211 inclusivity of local perspectives, where farmers, as extension agents, have embedded relational values.
212 Inclusivity may become explicit when experienced farmers, as extension agents, help describe,
213 articulate, and analyze such values. Relevance, trust, and place attachment are three critical relational
214 values in the farmer-to-farmer extension. Without them, farmers and extension agents will have
215 difficulty in defining the targeted goals for knowledge and innovations, communication, and learning
216 processes that enable a site-specific extension strategy.

217 Balancing these strengths of farmer-to-farmer extension is the recognized challenge of weak
218 interaction with external sources of knowledge and innovations. This challenges the external support
219 for formalized farmer-to-farmer extension. While privatization of extension was welcomed by the
220 agricultural input industry in the 'Green revolution' phase, markets for agricultural outputs that care
221 about social and environmental aspects of production have a role to play in the 'Rational
222 intensification' and 'Regenerative agriculture' phases. Further studies need to investigate how the
223 relational values in farmer-to-farmer extension can be assessed and utilized to increase the
224 connection between farmer-to-farmer extension and other reference groups as stakeholders of the
225 choices farmers make in the landscape and its value chains.

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